

PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)
(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference FP20061 | <div style="display: flex; justify-content: space-between;"> FOR FURTHER ACTION See Form PCT/IPEA/416 </div> | |
| International application No. PCT/AU2004/001093 | International filing date (<i>day/month/year</i>) 13 August 2004 | Priority date (<i>day/month/year</i>) 13 August 2003 |
| International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ D21C 3/04 | | |
| Applicant VIRIDIAN CHEMICAL PTY LTD et al | | |

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| 1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. | |
| 2. This REPORT consists of a total of 3 sheets, including this cover sheet. | |
| 3. This report is also accompanied by ANNEXES, comprising: <div style="margin-left: 20px;"> a. <input checked="" type="checkbox"/> (<i>sent to the applicant and to the International Bureau</i>) a total of 2 sheets, as follows: <div style="margin-left: 20px;"> <input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. </div> </div> <div style="margin-left: 20px;"> b. <input type="checkbox"/> (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions). </div> | |
| 4. This report contains indications relating to the following items: <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> Box No. I Basis of the report <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input type="checkbox"/> Box No. VIII Certain observations on the international application </div> | |

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| Date of submission of the demand 11 March 2005 | Date of completion of the report 14 September 2004 |
| Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929 | Authorized Officer THARU FERNANDO Telephone No. (02) 6283 2486 |

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2004/001093

Box No. I

Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item:

☐ This report is based on translations from the original language into the following language which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1 (b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

☐ the international application as originally filed/furnished

☒ the description:

pages 1-25 as originally filed/furnished

pages* received by this Authority on with the letter of

pages* received by this Authority on with the letter of

☒ the claims:

pages as originally filed/furnished

pages* as amended (together with any statement) under Article 19

pages* 26,30 received by this Authority on 28 September 2005 with the letter of 28 September 2005

pages* received by this Authority on with the letter of

☒ the drawings:

pages 1 as originally filed/furnished

pages* received by this Authority on with the letter of

pages* received by this Authority on with the letter of

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2004/001093

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

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|-------------------------------|-------------|-----|
| Novelty (N) | Claims 1-44 | YES |
| | Claims | NO |
| Inventive step (IS) | Claims 1-44 | YES |
| | Claims | NO |
| Industrial applicability (IA) | Claims 1-44 | YES |
| | Claims | NO |

2. Citations and explanations (Rule 70.7)

Novelty and Inventive Step (Claims 1-44)

The present invention is directed to the treatment of lignin-containing material by contacting the lignin-containing material with an ionic liquid in order to extract the lignin into the ionic liquid. Further, the invention is also directed to using the ionic liquid to treat lignocellulosic material such that the lignin is extracted into the ionic liquid while the cellulosic fibre is preserved.

The closest prior art document to the present invention is WO 2003/029329 (THE UNIVERSITY OF ALABAMA & PG RESEARCH FOUNDATION, INC) 10 April 2003.

This document discloses the use of ionic liquids to treat cellulosic material, not lignin-containing material. Further this document does not disclose the preferred classes of ionic liquid described in the present application.

Therefore the invention defined in claims 1-44 is novel and involves an inventive step.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method for the treatment of a lignin-containing material comprising contacting the lignin-containing material with an ionic liquid to extract lignin into the ionic liquid.
2. The method of claim 1, wherein lignin from the lignin-containing material extracted into the ionic liquid is recovered from the ionic liquid.
3. The method of claim 2, wherein solids remaining after the lignin has been extracted into the ionic liquid are separated from the ionic liquid.
4. The method of any one of claims 1 to 3, wherein the lignin-containing material is contacted with a single species of ionic liquid.
5. The method of any one of claims 1 to 3, wherein the lignin-containing material is contacted with a mixture of different ionic liquid species.
6. The method of any one of claims 1 to 5, wherein the lignin-containing material is contacted with a combination of the ionic liquid and a cosolvent.
7. The method of claim 6, wherein the lignin-containing material is contacted with a combination of the ionic liquid and water.
8. The method of any one of claims 1 to 7, wherein the lignin-containing material is contacted with a solvent composition comprising between 50 and 100% of the ionic liquid.

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33. The method of claim 32, comprising recycling the ionic liquid recovered following distillation for contacting with further lignin-containing material.

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34. A product produced by the method of any one of claims 1 to 33.

35. Use of an ionic liquid in the treatment of a
10 lignocellulosic material to extract lignin into the ionic liquid and preserve the cellulosic fibre.

36. Use of claim 35, wherein the ionic liquid comprises:

- 15
- an substituted or unsubstituted aryl organic acid anion; and
 - an ionic liquid-forming inorganic cation or an organic cation.

37. Use of claim 36, wherein the anion component of the
20 ionic liquid is a substituted or unsubstituted phenyl, naphthyl or pyridyl organic acid anion.

38. Use of claim 36, wherein the aryl is substituted by
25 between 1 and 4 substituents independently selected from the group consisting of alkyl, alicyclyl, aryl, aralkyl, alkylaryl, heteroaryl, halogeno, hydroxy, nitro, haloaryl and sulfonate.

39. Use of any one of claims 35 to 38, wherein the organic
30 acid anion is a sulfonate, sulfate, carboxylates, phosphinate or a phosphate.

40. Use of any one of claims 35 to 39, wherein the organic acid anion is a sulfonate.

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41. Use of any one of claims 35 to 40, wherein the anion is a substituted or unsubstituted aryl disulfonate anion.